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A PURE THEORY OF INTERORGANIZATIONAL CONFLICT

by

Makoto Takamiya

November 1974 WP 747-74

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Introduction

1. Modern Society and Inter-organizational Conflict

Modern society is often said to be an "organizational society." The influence of individual will has already become very small, being replaced by a few big organizations which have a critical effect on almost all aspects of society. In political science, social decision making has been explained in terms reflecting the aggregation of individual value by majority voting systems. But contrary to the prevailing view of classical political sciences, almost all important social decisions are the outcome of bargaining and compromises among large bureaucracies and small numbers of political pressure groups. Also in classical economics, economists have been explaining social decision making as an aggregation of subjective equilibrium of individual rational behavior through perfectly competitive markets.

In the real world, however, final consumer goods are not produced by a large number of small size industries nor bought by an infinite number of individual consumers; instead a small number of gigantic corporations are producing and another small number of big consumer organizations along with the government are evaluating commodities. The wage rate is determined not by the marginal productivity of labor, but by bargaining conducted by big corporations and labor unions. Thus most of the socially important decisions are made through interaction among very large organizations which are not necessarily related in a direct way to the decisions of individuals.(1)

On the other hand, as many scientists have shown, the classical market mechanism and the voting systems have desirable properties as a

social decision making mechanism under certain conditions. In welfare economics, it is known that for any given initial income distribution competitive equilibrium is necessary and sufficient to achieve Pareto optimality (Henderson and Quandt, 1971). In a less formal manner, many classical political philosophers have been discussing the desirability of voting. However, as pointed out above, in today's world, socially important decisions are not made solely by these "desirable" mechanisms but as a by-product of interactions among big organizations. Nevertheless, there are no theories which treat the desirability or undesirability of such a social decision making system. Is the present mechanism which produces social decision as a result of organizational interactions desirable? If not, what additional conditions are necessary to make it so? These are urgent questions that have to be answered. To answer these questions, we need a theory that analyses the mechanism involved in organizational interaction.

2. Purpose and Structure of This Study

In order to examine the properties of inter-organizational conflict, we must have a general model that describes the mechanism common to any inter-organizational conflict. In the following sections, a pure model of such a conflict will be developed.

In developing the model, the following problems are addressed:

(1) If an organization is in conflict with another one, how do they typically behave?

(2) What inter-organizational and environmental factors influence

the organizational behavior in conflict, and in what way?

(3) If the organization is influenced by factors which will be explained, and if such organizations are facing each other in conflict relations, what process and which direction will the system of these conflicting organizations take?

(4) As a result of this interaction process, will the system reach an equilibrium or not?

(5) If there exists an equilibrium, under what conditions is it stable?

(6) If the number of conflicting organizations in the system is more than two, what new phenomenon which we can not observe in two-organizational conflict will emerge?

(7) And finally, if there exists a stable dynamic equilibrium to which a system of two conflicting organizations automatically heads, is this equilibrium a rational resolution? (i.e. Does the equilibrium satisfy Pareto optimality?)

In the first section, definitions of some basic terminology as well as a model relating to question (1) and (2) above will be developed. In the second section, the model introduced in the previous section will be modified so as to become dynamic, thus giving an answer to questions (3) through (6). In the third section, the rationality of the stable equilibrium (question (7)) will be examined. In the final section, a summary will be given and the deficiencies of the model will be discussed.

I. Pure Model of Inter-organizational Conflict -- A Static Model

1. Definitions of Basic Concepts

In a separate paper, the present author has pointed out some confusion in the treatment of conflict by organizational scientists and proposed a new concept of conflict (Boulding, 1962), (Takamiya. 1974).

(a) Party

Participants in a conflict situation are called parties. A party is assumed to have the following properties:

(1) It has a set of alternative actions from which it chooses one.

(2) It has a certain knowledge (perfect or imperfect) of the consequences of its actions.

(3) It has a value ordering system according to which it evaluates the consequences of its actions.

(4) Using some rational criteria (e.g. maximization of utility in case of perfect information, maximization of expected utility or maximization of minimum payoff or "satisficing" in case of uncertainty), it will choose the alternative whose consequence optimally satisfies the criterion used.

(b) Interdependency or Externality

Consider a decision making situation which involves more

than two decision makers. If one party's (perceived) consequences of some alternative action vary with the actions taken by the other, their relation is said to be interdependent, or an externality is said to exist.

(c) Competition

In an interdependent decision situation (or a decision situation with an externality), if there exists some possibility that one decision maker can become better off only at the expense of others, then this interdependent relation is said to be competitive. Alternatives which yield competitive interdependency are called competitive actions.

(d) Conflict

A conflict relation is a special case of a competitive interdependent relation in which two parties are aware that their relation is interdependent and competitive, and in which both parties desire to take competitive actions

These are the basic concepts which are used in the following discussions. Now the problem is to construct a model which describes the situation when two organizations are thrown into a "conflict" situation in the above sense.

2. A Static Model of Inter-organizational Conflict

Consider a system which consists of conflicting organizations.

This system assumes a certain "state" at some given time, due to the interaction process peculiar to conflict. Our first problem is to describe the mechanism that determines the "state" of the system. In this section, the static version of the model will be presented.

In international conflict, a "state" of the system might be represented by the level of armament of one country directed to the other or some other appropriate variable that is related to "willingness to fight." Or in inter-firm conflict, the state of conflict can be represented by the price level set by each company. If both companies set prices low, a state of conflict can be said to be very vehement. In wage negotiation, the state of conflict can be represented by the attitude of management and labor, which may be reflected in the wage proposals of each party. Thus if management proposes a very low wage while the labor demands a high wage rate, the state of conflict can be regarded as very serious. Generally in any conflict, the state of the system of conflicting parties can be assumed to be represented by some kind of "attitude" held by each party toward the enemy party. We name this variable "hostility."

(Assumption 1)[2]

A state of inter-organizational conflict at any given time can be represented by a vector (H_1, H_2), where H_1 (H_2) denotes the "hostility" of organization 1 (organization 2) toward the other organization 2 (organization 1).

Social scientists in many scattered fields have asserted propositions concerning factors that influence the level of hostility. In

constructing a static version of our model, these diverse works on hostility level will be surveyed and utilized.

(1) Factors affecting Hostility Level

(a) Influence From Enemy Organization

In international conflict, it is known that a rise in an armament level of one country is likely to induce a rise in an armament level of an opponent. It is also true in an oligopoly market that if a company lowers its price, motivation for its competitor to follow suit increases. Generally we have

(Proposition 1-1)[3]

A rise in the hostility level of an organization will increase the hostility level of the opponent organization and vice versa.[4]

(b) Inter-organizational Factors

It is well-known that members' identification with their organization influences the organization's level of hostility towards an enemy organization. This phenomena can be explained as follows: threats to each member's life and threats to the organization are generally different. But if a member's identification with the organization is high, he tends to regard the enemy of his organization as his personal enemy. He regards it as a threat to his life. If a substantial proportion of members identify themselves with the organization and thus regard the organization's enemy as their personal enemy, hostility of the organization toward the organization's enemy is likely to be high.

(Proposition 1-2)

The greater the members' identification with their organization, the greater the hostility level of the organization.[5]

According to March and Simon's survey, it has been shown that the member's identification in turn depends on five variables.[6] If we adopt their argument, we have

(Proposition 1-3)

A member's identification toward an organization will increase as

(a) perceived prestige of the organization increases,

(b) their perceived goals are shared to a greater extent,

(c) frequency of intra-organizational interaction increases,

(d) more of the individual's needs are satisfied in the group, and

(e) the amount of intra-organizational conflict decreases.

From the combination of propositions (1-2) and (1-3), some interesting predictions may be suggested. For example, radicals who consider themselves as an advanced guard, the faculty of the University of Tokyo whose authority was attacked by a students movement, "sacred Japan" which fought with "beast American" 30 years ago, "Great" Mitsubishi having been attacked for its military products. All these organizations which perceive themselves as prestigious have high identification from members (Proposition 1-3 (a)) and therefore have an inner mechanism which makes them more hostile towards any enemy organization (Proposition 1-2). In fact, these organizations showed very aggressive behavior in their conflicts. Similarly, a firm whose wage and promotion system forces employees to compete against each other may be inclined to have low identification (Proposition (1-3) (e)), and therefore be less likely to take an aggressive strategy in an oligopolistic market.

On the other hand, hostility toward an enemy in turn tends to increase members' identification with their organization. This phenomenon can be clearly observed in an organization which does not have much to satisfy members' needs but needs their loyalty (for example, a radical group, a union which failed to get a desired wage, etc.) In fact most of the policy that a radical group takes can be interpreted as trying to "create" an enemy in order to obtain a high identification from its members. Boulding discusses this issue in a broader perspective (Boulding, 1962).

> It seems to be a fact that most organizations can increase the internal rewards of their role occupants by putting the organization in a situation of strain or conflict... A strong enemy is a great unifying force; in the face of a common threat and the overriding common purpose of victory of survival, the diverse ends and conflicting interests of the population fall into the background and are swallowed up into the single, measurable, overriding end of winning the conflict. We see this principle operating most clearly in alliances; the threat of Hitler, for instance, produced an alliance between the Western powers and Russia that fell apart as soon as the common threat disappeared. In many ways, organizations are creations of their enemies, and it is through a common hatred of the enemy that they establish their internal unity. We see this not only in nations -- where George III's England created the United States, Napoleon's France created Germany, and so on -- but in labor unions, where enmity of the employer frequently creates a solidarity of feeling that no mere common interest could create, and even in churches, where a sect often establishes its internal unity by battles against the heretic and the unbeliever.

Thus we assert

(Proposition 1-4)

A rise in hostility will induce a rise in members' identification.(7)

This feedback process between hostility and identification seems to have a very important meaning in explaining the possibility of an explosion

of hostility without any interaction with the enemy. Proposition 1-2 states that high hostility induces high identification. But an increase in identification tends to raise hostility level by Proposition 1-3, which in turn, increases identification. If this process is diverging, the organization will begin to fight (war or price competition, etc.) without any manifest aggressive behavior of the opponent.[8] This instability may partially explain the irrationally aggressive behavior of Hitler's Germany, Militarist Japan 30 years ago and some extreme radicalism in developed countries.

Next we may consider a proposition that deals with the relation between frustration and hostility. In several psychological studies on emotional adaptation,[9] it is argued that human behavior tends to be aggressive under frustration. For example, Sherif studied two groups in a boys' camp, one of which was manipulated so as to be frustrated. In this field experiment, the behavior of the frustrated group was observed to be much more aggressive than the non-frustrated one.[10] Homans also agrees on this causal relation between frustration and hostility. He argues,

> When a man is frustrated, he is apt to perform aggressive actions. These are actions that attack, break, hurt, or threaten the source of the frustration, whether the real source or what the man perceives it to be. If for any reason the real source can not be attacked, almost any target will do in a pinch. (Homans, 1961)

Accordingly, we will assert,

(Proposition 1-5)

The greater the level of frustration, the higher the level of hostility.

The level of frustration is determined by the difference between the

aspiration level and the actual level of achievement. Since it is much easier to attain a goal in a rich environment, actual level of achievement is positively correlated with the richness of the environment.

(Proposition 1-6)

The larger the difference between the level of aspiration and the actual level of achievement, the higher the member's level of frustration.

(Proposition 1-7)

The richer the environment (the more the resources available), the higher the level of achievement.

The level of hostility is also dependent on the goals of its members. It is very difficult to state clear-cut propositions bearing on the relation between members' motivation and the level of organizational hostility. An interesting experiment was conducted by Turhune. Three experimental groups were formed. The first was a group whose members were motivated by goal achievement (called NACHES), the second was a group whose members were motivated to live peacefully with others (NAFFS), and the last group had members motivated by power (NAPOS). The three groups played the prisoner's dilemma game. The results of the experiment showed that the most cooperative group was NACHES, followed closely by NAFFS and lastly by NEPOS.[11] This experiment of course deals with only one aspect of the relation between members' motivation and the level of hostility. But at least we can assert,

(Proposition 1-8)

The level of hostility of an organization depends on the goals of ite members.

(c) Environmental Impact on the Level of Hostility

The level of hostility is influenced not only by the opponent party's behavior and by the intra-organizational factors but also by the environmental factors. Within the framework of game theory, environmental factors can be expressed by "payoffs" and "rules" of the game. In experimental studies of game situations, there are a set of studies which try to clarify the impact of a change in payoffs or rules on the strategies the players use. Since some of their results are widely accepted and can be easily generalized, we will introduce some of their important results.(12)

(Proposition 1-9)

The greater the experience in facing similar conflicting situations, the lower the level of hostility.

If people are asked to play a series of prisoner's dilemma games, it is generally observed that as they go on playing many games, the rate of cooperative strategy adopted will increase. This is because the player acquires an educational experience so that his risk involved in taking cooperative action will decrease.

This phenomena can be observed not only in controlled experiments, but also in our everyday life. For example, consider a budgeting process. Budgeting is basically a division of limited resources. A division of limited resources usually results in an aggressive conflict. However

in a budgeting process in a big business organization or governmental bureaucracy, violent conflict rarely takes place because budgeting occurs once a year so that people in charge get enough experience to handle the process. Thus routinization prevails in many aspects of a budgeting process.

This proposition can also be illustrated by the behavior of a firm in an oligopolistic market. In an early stage of development of a new industry, there are always high competition for survival, highly aggressive pricing policies and new entries. But as the industry "matures", each firm learns the competitors' response as well as characteristics of the market and begins to form an implicit agreement on pricing. (A good example is the formation of price leadership).

The level of hostility is also known to be dependent upon the amount of communication allowed. In a series of prisoners' dilemma games, it has been observed that the rate of cooperative strategies tends to increase when communication between the players is allowed. Again the same phenomenon can be observed in oligopolistic markets. If we compare an oligopolistic market of some industry in a country where anti-trust laws are so severely enforced that the communication between the competing firms becomes relatively difficult (as in the U.S.) with the same oligopolistic market in a country where communication between the firms is relatively permitted (as in Japan), the conflict between firms in the former market is generally observed to be more vehement than in the latter market. Thus we assert,

(Proposition 1-10)

As an amount of communication between the parties increases, the

level of hostility decreases.

As previously mentioned, payoffs to a party depend upon the strategy it chooses and the strategy taken by the opponent. Therefore, if the payoff to the same combination of strategies changes, the party's strategies are likely to be changed.

In game theoretic experiments, this inference is confirmed. If the loss (negative payoff) in the case where both parties take aggressive strategies is increased, then it is generally observed that they tend to choose cooperative strategies more than before. In addition, if the payoff to a party in a situation where it chooses an aggressive measure while the opponent takes a cooperative strategy is decreased, then the motivation to take an aggressive measure will decline.

In international relations, the strategies that big countries adopt are now much milder and more compromising than before World War I. At that time, assassination of a prince might be a good enough reason to declare war. Today, since weapons are so potential and abundant that one big nation could destroy the entire world, countries are more cooperative in their strategies than in the past. Thus we assert,

(Proposition 1-11)

As the expected value of the cost from adopting an aggressive strategy toward the opponent party increases, the level of hostility declines.

The next proposition concerns the relation between the abundance of environment and level of hostility.

Wage bargaining between union and management in a highly growing

country (such as in Japan before 1972) tends to be much milder than that in a stable or shrinking economy (such as in Britain in 1974, India in 1974, Italy in 1973-1974). In a rapid growing economy, the "pie" to divide is larger than in a non-growing economy, making it possible for both labor and management to be better off. In a non-growing economy, however, increase in labor's share results directly in a decline in management's share. Thus,

(Proposition 1-12)

As the environment becomes more abundant, the level of hostility decreases.

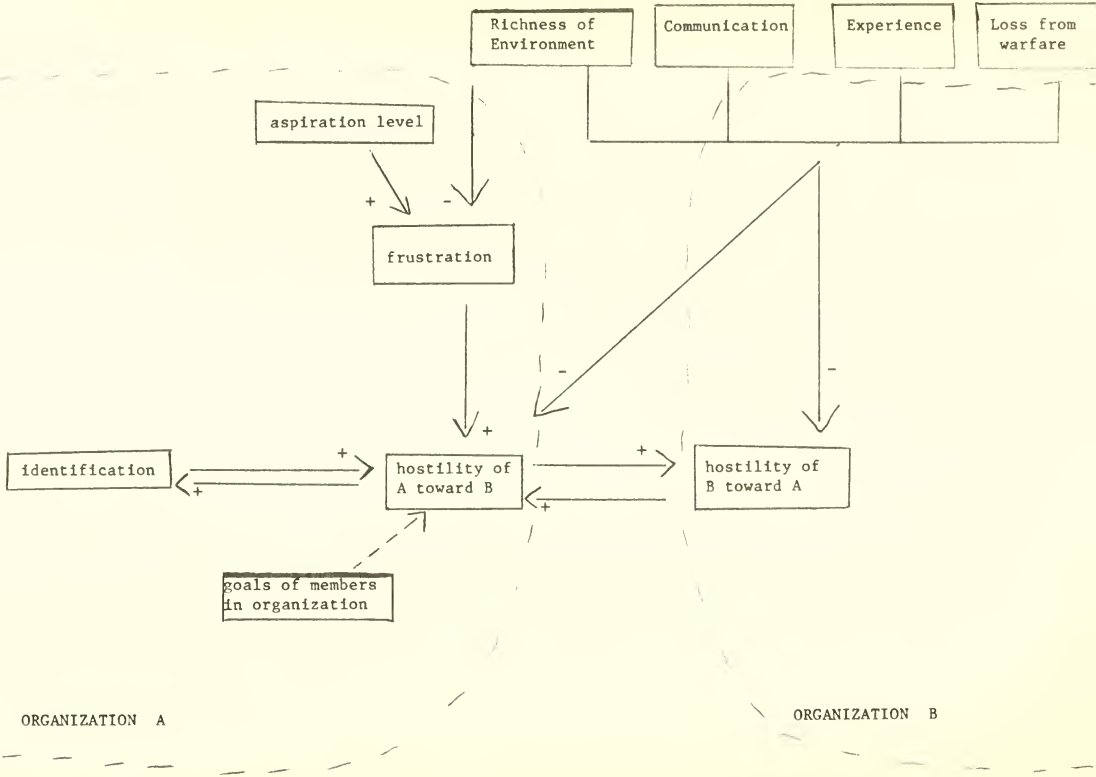
It is intuitively obvious that the value system of an organization relates to its level of hostility. However, there appears to be no widely accepted proposition which sets definite relations between them. The following assertion, without pretending to be inclusive, introduces one interesting aspect of this issue. It states, "As the value system of two organizations becomes similar, the level of hostility gets higher." This may sound paradoxical, but there are a number of phenomena that fit this assertion. For example, the hostility of political radicals toward liberals is often much stronger than toward conservatives who are theoretically their enemy and is much stronger toward other radical groups than toward liberals. Thus conflicts between Red China and the Soviet Union as opposed to the Soviet and U.S., or fighting between Japanese radicals are good examples of this. Similarly conflicts among different religions are often much weaker than conflicts among sects

within the same religion. After the Luther's Reformation in 1517, the conflict between Catholics and Protestants was much stronger than that between Christians and Moslems.

In the economic context, this proposition is trivial. For example, competition among firms in the same industry is obviously much stronger than among firms in different industries.

Although there are many phenomena that can be explained by this proposition, it can not be considered a widely accepted one. There are many other equally persuasive ways of stating the relation between value and hostility.(13)

Now the set of propositions we have asserted can be illustrated in Fig. 1.


Richness of Environment
Communication
Experience
Loss from warfare
aspiration level
+
-
frustration
-
-
+
identification
+
+
hostility of A toward B
+
+
hostility of B toward A
goals of members in organization
ORGANIZATION A
ORGANIZATION B

II. Pure Model of Inter-organizational Conflict

-- A Dynamic Model --

1. A Two-Party Dynamic Model

In the introduction, seven problems that needed resolution were presented. Although the static model developed in the last section could clarify the first two problems, it is hopelessly insufficient to deal with the problems (3) through (7). In order to give them fairly complete answers, we have to construct a dynamic model which clarifies the dynamic path along which a state of conflict moves as time goes on and the dynamic equilibrium to which it will automatically be directed.

In this section, the static model will be made dynamic by introducing a simplifying assumption.

(Asaumption 2)[14]

Intra-organizational and environmental factors are constant during the time span of our concern.

Members' identification, aspiration level, frustration and motivation, were given as intra-organizational factors that influence the level of hostility. Identification is determined by past history and the cultural background of the organization; aspiration levels and frustrations are determined by past experience; members' motivation is determined by their background and by organizational climate. All of these causes can be assumed to be constant during the time of

our concern.

Similarly environmental factors can be plausibly regarded as external to our model. Given a certain conflict at a certain time, for example, price competition, the abundance of environment would be determined by the change in demand and general economic conditions, amount of communication is determined by the law and attitudes of the authority, experience is determined by past history, and the expected loss from cut-throat competition depends upon the market and size of the firm, etc, all of which can be regarded as external to our model.

If this assumption is adopted, we can plausibly regard interactions between levels of hostility of each organization as the only dynamic factor in our model. Therefore from now on, my discussion will concentrate on this interaction between hostilities. In order to construct a dynamic model, the interaction relation between hostilities of two organizations must be specified.(15)

The positive correlation between two hostility levels is asserted in Proposition 1-1. Restating it, we get

(Proposition 2-1)

The level of hostility of one party increases as the level of hostility of the opponent increases.

Therefore if the hostility of one party increases, it will cause the other's hostility to increase, which in turn increases the hostility

of the former party... Obviously this process can not continue forever. In international conflict, for example, as the armament of a country expands, domestic factors will begin to work as a constraint to a further expansion. It may become more difficult to finance a further expansion of armaments, or political objections to an unfair distribution of national wealth may arise as the level of armament is growing.(16) In an oligopoly, the wish to lower the price will be reduced by the firm's financial situation. As the price declines, it becomes increasingly difficult for a firm to further reduce its price.

(Proposition 2-2)

There exists within an organization a mechanism checking an expansion of its hostility. This restraining function increases with the level of hostility.

(Proposition 2-3)

Within an organization, there exist independent factors which influence the hostility level, i.e. factors that are related to neither the hostility levels of the organization nor that of the enemy.

Armament level or price level is influenced by independent factors in the organization. Even if the conflict does not objectively exist, if a party has a professional suborganization in it whose function is to fight with others, this professional suborganization may work on raising the hostility level.(17) This phenomenon is often observed in countries with a military government or in the United States where the munition industry is huge and politically powerful. Similarly the mere existence

of a radical minority in a labor union tends to increase the hostility level of that union. (For example, Japanese and Indian railway unions in their wage negotiations in 1974).

With these propositions, we can construct a dynamic model of a two-party conflict. Let H_1 be the hostility level of organization 1 towards its rival organization 2 and H_2 be the hostility level of organization 2 towards 1. The interaction processes between H_1 and H_2 which are characterized by the propositions above can be essentially represented by the following system of differential equations (Here linearity is assumed for the sake of simplicity).

$$\frac{d H_1}{d t} = a_1 H_2 - b_1 H_1 + c_1 \qquad (1)$$

$$\frac{d H_2}{d t} = a_2 H_1 - b_2 H_1 + c_2 \qquad (2)$$

where the a's and b's are all positive.

The a terms on the right side of the equations correspond to the assertion of proposition 2-1, the b terms to the proposition 2-2 and the last terms (c) to the proposition 2-3.

To avoid the unnecessary mathematical complication, the wellknown method of phase diagram will be used. The necessary and sufficient condition for the equilibrium of the system of the two conflicting organizations 1 and 2 is

$$a_1 H_2 - b_1 H_1 + c_1 = 0 \qquad (3)$$

$$a_2 H_1 - b_2 H_2 + c_2 = 0 \qquad (4)$$

Therefore the equilibrium solution is

$$H_1^* = \frac{a_1c_2 + b_2c_1}{b_1b_2 - a_1a_2} \tag{5}$$

$$H_2^* = \frac{a_2c_1 + b_1c_2}{b_1b_2 - a_1a_2} \tag{6}$$

We can depict the conditions (3) and (4) as two lines in a two-dimensional graph. Suppose these are drawn as in Fig. 2, where the slope of line (3) is steeper than that of line (4) $(a_2/b_2 < b_1/a_1)$. In this case, the hostility levels of the two organizations converge to an equilibrium point. This convergence can be shown by the following reasoning. If the initial state of conflict can be described by point A (hostility of organization 1 is $\bar{H}_1$, that of organization 2 is $\bar{H}_2$) we have $\frac{dH_1}{dt} > 0, \frac{dH_2}{dt} < 0$. Namely, for organization 1, its hostility level at A is too low for the given hostility level of organization 2. Organization 2, on the other hand, regards its level of hostility at A is too high for the hostility level of organization 1. Therefore organization 1 tries to adjust by raising its hostility level and organization 2 by lowering it. Therefore the system tends to move to the state which can be represented by a point south east of A. This move of the system will continue until the state of the system is located north west of the both lines. At D, where the trajectory and the line $\frac{dH_2}{dt} = 0$ cross, we have $\frac{dH_1}{dt} > 0$, $\frac{dH_2}{dt} = 0$. Therefore for organization 2, its level of hostility matches that of organization 1, whereas organization 1 still regards its hostility level as too low for that of organization 2. Therefore organization 1 continues to expand its hostility while organization 2 is in an equilibrium

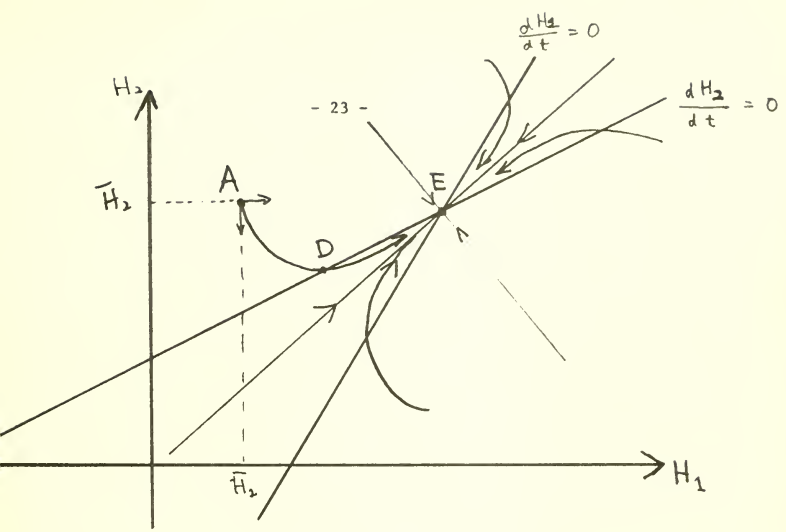


Fig. 2.

and does not change its hostility. Hence the state of the system will move to the east horizontally. After passing D, the state of the system will enter "the south west portion" of the two lines. Here we have $\frac{dH_1}{dt} > 0$, $\frac{dH_2}{dt} > 0$. After D, since organization 1 increases its hostility, organization 2 will begin to think its hostility level too low and try to increase it. Therefore the state of the system will move toward the north east direction. Once it reaches E, each organization regards its hostility level as just right given the level of hostility of the other. So there is no motive to move away from it.

By similar reasoning, we can show that starting from any point in the graph, the state of the system will be led to E and that after any incidental deviation from E, the state of the system will return to E. Therefore, in this case ($\frac{a_2}{b_2} < \frac{b_1}{a_1}$), E can be said a "stable equilibrium."

In the case where the two lines are drawn as in Fig. 3, the slope of the line $\frac{dH_1}{dt} = 0$ is less than the line $\frac{dH_2}{dt} = 0$: $\frac{b_1}{a_1} < \frac{a_2}{b_2}$.

By a similar argument, we can easily show that the equilibrium is E but that E is unstable in the sense that deviation from E will tend to increase. Suppose the initial condition is S. At that point, $\frac{dH_1}{dt} > 0$, $\frac{dH_2}{dt} < 0$. Therefore organization 1 tries to increase its hostility and organization 2 to decrease it.

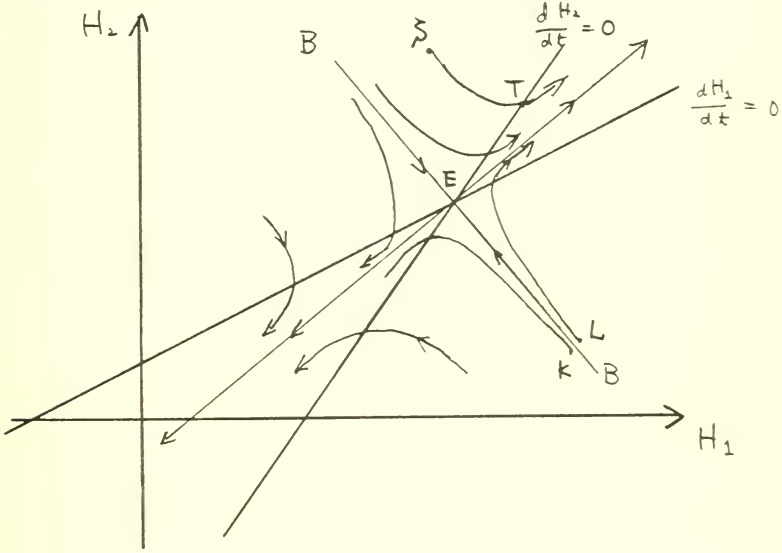


Fig.3.

The state of the system, as a result, tends to move toward the south east. When it moves to the line $\frac{dH_2}{dt} = 0$ at T, organization 2 is in equilibrium and does not change its hostility while organization 1's hostility continues to increase. Therefore the state of the system moves toward the east at T. However since organization 1 has increased its hostility from T, organization 2 begins to think its hostility level too low for the new level of the opponent's hostility. Therefore it will raise its hostility and the system will blow up to the north east direction. Here the escalation process begins and results in infinite hostilities. Point E at Fig. 3 is a special point. At E both organization's hostility levels are in equilibrium and so the state of the system does not change. However if incidental deviation from E takes place, the deviation does not shrink but enlarges itself to infinity. So point E can be called "an unstable equilibrium."

Summarizing the above discussion, we have obtained,

$$H_1^* = \frac{a_1c_2 + b_2c_1}{b_1b_2 - a_1a_2}$$

$$H_2^* = \frac{a_2c_1 + b_1c_2}{b_1b_2 - a_1a_2} \qquad (7)$$

and its stability condition is,

$$\frac{a_2}{b_2} < \frac{b_1}{a_1}$$

The meanings of these mathematical conclusions are still vague. Since our main concern is to get socially meaningful propositions, we shall go on to clarify the meanings of our conclusions in social

scientific terms.

(a) Meaning of the equilibrium point E

Since our model does not include rational cooperative action in the game theoretic sense, the equilibrium point E can be regarded as "balance of power" rather than a resolution of conflict.

(b) Social meaning of the stability condition

Since the line $\frac{dH_1}{dt} = 0$ shows the equilibrium hostility level of the organization for a given level of the other organization, $\left.\frac{dH_1}{dH_2}\right|_{\frac{dH_1}{dt}=0} = \frac{a_1}{b_1}$ represents an amount of hostility change required for organization 1 to maintain its hostility in an equilibrium state when the hostility level of organization 2 is changed. By the symmetric argument, $\left.\frac{dH_2}{dH_1}\right|_{\frac{dH_2}{dt}=0} = \frac{a_2}{b_2}$ shows the amount of hostility in organization 2 necessary for 2 to keep its equilibrium when organization 1's hostility level has changed. Therefore $\frac{a_1}{b_1}$ can be plausibly called the sensitivity of organization 1's response to a change in organization 2's hostility level. Symmetrically $\frac{a_2}{b_2}$ denotes organization 2's sensitivity.

The conclusion on stability we have obtained above shows that as the sensitivity of one party toward the other's behavior change increases, the stability of the system decreases and that if the increase in sensitivity goes up so high as to make $\frac{a_1}{b_1}\frac{a_2}{b_2} > 1$, the system becomes

unstable.

This is an interesting result. If we can assume linearity of hostility interaction, measurement of both parties' sensitivities of response toward the other's behavior and initial conditions will enable us to predict the long run results of inter-organizational conflict (whether there will be a war or not, whether there will be cut-throat competition or not, etc.) Richardson made just such an attempt to analyze the armament level of major countries before World War I and showed that the international system before the war was unstable and that the war could have been predicted. (Richardson, 1960)

(c) Meaning of divergence of a state in a social context

In an unstable system, hostilities (H_1, H_2) diverge to $\pm \infty$. This, although mathematically conceivable, can not possibly occur in the real world. The set of equations we used should be considered to be valid within a certain bounded area. If a state of the system goes beyond that bound, the relation between the two organizations will change drastically so that the set of equations will no longer be valid. Let me call this bound an endurance bound of the system. If the system is unstable and a state is on the trajectory that will lead it to $(H_1, H_2) \longrightarrow (+\infty, +\infty)$, the system will reach its endurance bound after some time and then will break down (for example, a war in an international conflict, cut-throat competition in oligopolistic conflict, divorce in marital life) or will change itself in a more moderate way (for example new contracts or a treaty in an international conflict, some implicit agreement on pricing in an oligopolistic market).

On the other hand, in the case where a state of the system diverges to ($-\infty$, $-\infty$) (i.e. infinite friendliness ?), the system will sooner or later reach the lower endurance bound. As a result a new relation will be established. The new relation may be an annexation of a country, a merger of firms, or a marriage, depending on the nature of a particular conflict.

(d) Significance of the initial point

In an unstable system, the initial point has a very critical influence on the result of the conflict (the importance of "first impressions!"). In order to illustrate this point, let us look at points K and L in Fig. 3. Suppose at the start of conflict, the system is at K. The trajectory in Fig. 3 shows that the system will go to negative infinite hostility (infinite friendliness). However if the initial state K changes a little (say to L), the Fig. 3 shows that the system will be led to infinite hostility. This illustrates that in some cases the initial situation (how to start conflict) is critically important in determining the long run result of the conflict. The first impression made upon us by someone sometimes determines a large part of our relationship with him.

The line BEB separates the area into two regions, one which leads the system to ($+\infty$, $+\infty$), the other to ($-\infty$, $-\infty$). Richardson called this line a barrier (Richardson, 1960). The argument above shows that as long as the initial state of the system lies on the same side of the barrier, no matter how different the initial states are, the long run results of the conflict will be the same. On the

other hand if the two initial states belong to different sides of the barrier, no matter how near they are, the limiting result will be opposite (a war vs. an alliance, cut throat competition vs. cooperative agreements, etc.). Therefore in real conflict, it is of critical importance to know the position of the barrier in predicting the result of the conflict.

By constructing a dynamic version of the model, three more questions are answered ((3) through (5)). It is not difficult to modify our less formal but more illustrative argument to a more rigorous and general mathematical discussion. However, a mathematically rigorous treatment seems unlikely to generate any new meaningful propositions other than those which have been discussed. Readers who are interested in such a mathematical discussion should refer to (Richardson,1960) or (Takamiya, 1972).

2. Generalization to N-Party Conflict

This section generalizes the two party system model to an n-party system. In the first part of this section the equilibrium point and its stability conditions of n-party conflicting system will be derived. In the second part, the problem of the relation between partial stability (stability of a part of the system) and global stability (stability of the whole system), peculiar to n-party conflict, is discussed.

(a) The Theory of N-Party Conflict

Let H_i be a hostility level of the i'th organization (i=1,...,n).

By the same reasoning, as in the two-party case, a value of H_i tends to increase by a rise in another organization's hostility level H_j $(i \neq j)$ and tends to decrease as its own hostility level H_i increases. Again assuming linearity for simplicity, we obtain,

$$\frac{dH_i}{dt} = c_i + \sum_{j=1}^{n} k_{ij} H_j \qquad (i=1,\ldots,n) \tag{8}$$

where k_{ij} $\begin{cases} > \\ < \end{cases}$ 0 when $i \neq j$: Defense coefficient

0 when $i = j$: Fatigue coefficient

The equilibrium of this system is given by the solution to the set of linear equations

$$K H + c = 0 \tag{9}$$

where K is a matrix whose elements are k_{ij}.

Let K_{ij} be a i-j cofactor of K. The equilibrium point in the system is given by

$$H_i^* = \frac{1}{|K|} \sum_{j=1}^{n} (-c_i K_{ij}) \tag{10}$$

where $|K|$ denotes a determinant of matrix K.

As is well known,[18] the stability condition for the equilibrium is

Real parts of all the eigenvalues of the matrix K should be all negative. (11)

(b) The Relation Between Stability of the Parts and the Stability of the whole

If the number of parties is greater than two, there arises a very interesting problem concerning the relationship between partial

stability and global stability. When any two party relationship in an N-party system is unstable, can the whole system absorb their instability and be stable as a whole? Or conversely, when all the two-party relations in the n-party system are stable, is the whole system necessarily stable?

Without serious loss of generality, this problem will be discussed in the framework of a three party conflict. In the three party case, the characteristic function becomes

$$\begin{aligned} f(\lambda) &= |K - \lambda I| \\ &= \lambda^3 - (k_{11} + k_{22} + k_{33})\lambda^2 \\ &\quad + (k_{22}k_{33} - k_{23}k_{32} + k_{33}k_{11} - k_{31}k_{13} \\ &\quad + k_{11}k_{22} - k_{12}k_{21})\lambda - |K| \\ &= 0 \end{aligned} \tag{12}$$

Suppose that the relationship of any two party is unstable, then as we have already shown in the two party conflict model, we obtain

$$\begin{aligned} k_{23}k_{32} &> k_{22}k_{33} \\ k_{31}k_{13} &> k_{33}k_{11} \\ k_{12}k_{21} &> k_{11}k_{22} \end{aligned} \tag{13}$$

From this inequality, we get

$$\begin{aligned} |K| &= (k_{22}k_{33} - k_{23}k_{32})k_{11} + (k_{23}k_{31} - k_{21}k_{33})k_{12} \\ &\quad + (k_{21}k_{32} - k_{22}k_{31})k_{13} \\ &> 0 \end{aligned} \tag{14}$$

Therefore $f(0) = -|K| < 0$. Since $f(\lambda)$ goes to infinity as λ goes to infinity, from the mean value theorem we know that the equation $f(\lambda) = 0$ has at least one positive root. From (11), the system as a whole is

unstable. Thus we have derived the following results.

If the relation between any two parties is unstable, the system as a whole is also unstable. (15)

Next let us consider the opposite case where any two party relation is stable. In this case, is the whole n-party system stable, too?

From the assumption of stability of two party relation, we get

$$\begin{aligned} k_{22}k_{33} &> k_{23}k_{32} \\ k_{33}k_{11} &> k_{31}k_{13} \\ k_{11}k_{22} &> k_{12}k_{21} \end{aligned} \tag{16}$$

However (16) does not uniquely determine the sign of $|K|$. Therefore $f(\lambda)$ can be negative at $\lambda = 0$. In this case by the mean value theorem $f(\lambda) = 0$ has a positive root. Hence the whole system may be unstable. Therefore we can conclude

Although all the two party relationships are stable, the system as a whole can be unstable. (17)

This conclusion seems to explain several social phenomena. For example we often come across the following experience. In a group of one boy and two girls, any two person relationship of these three persons taken separately from the remaining one may be smooth and stable. But when the three get together, the relation of these three persons can be unstable and awkward. Our theoretical conclusion seems to explain

such an everyday phenomenon.

On the other hand, (17) can be used to point out the methodological deficiency in international political science, which has been mainly concerned with "international relations" between two countries. But as our conclusion shows, the stability of any two-country relationships does not mean stability of the world as a whole. Because of this, studies of "international relations" are not sufficient for understanding the dynamics of world politics.

By developing a static and dynamic model of inter-organizational conflict, we have (1) clarified the nature of organization's behavior in conflict situations and (2) introduced the various factors that influence the intensity of conflict and specified the direction of their influence. Using some simplifying assumptions, (3) we have tried to make this static model dynamic and clarified the process and path along which the system will move, and (4) derived the concept and condition of equilibrium and (5) its stability condition. We have also (6) generalized the model to the N-Party conflict case and derived several important implications and conclusions.

As our argument shows, the state of inter-organizational conflict tends to be directed towards a certain situation (e.g. balance of power, hot war or friendly relations) independently of the parties' conscious aims. If so, what property does the result of the conflict have? Is the state to which the system is led desirable to both parties? In other words, does inter-organizational conflict have a built-in mechanism that automatically assures a rational solution? This is the central question to be answered in the next section.

III. Equilibrium Solution and Rationality[19]

This section discusses the problem of the rationality of the equilibrium point in terms of a certain specific conflict (namely, inter-firm conflict in a duopoly market) to prove that the equilibrium point is not a rational point.

Let us consider some duopoly market. In this case, the price level set by each firm is taken as a negative hostility (namely, setting the price low means high hostility). Profits for each firm depend on the two price levels that each firm sets. Thus in the hostility diagram used in the last section, isoprofit curves for each firm can be drawn. We call the two firms firm A and B, and first specify a shape of isoprofit curves of firm A. As is generally assumed, if the price level of firm A (P_a) is fixed, profit of A increases as P_b (price level of firm B) increases. This is due to the fact that customers of firm B change to firm A due to the higher price of firm B's commodity. The other factor that influences the profit of A is P_a. If P_b is fixed, the profit of firm A increases to a certain point as P_a increases and beyond that point, decreases as P_a continues to increase. Assuming the same functional relation for profit of firm B, we can get indifference curves of both firms as shown in Fig. 4.

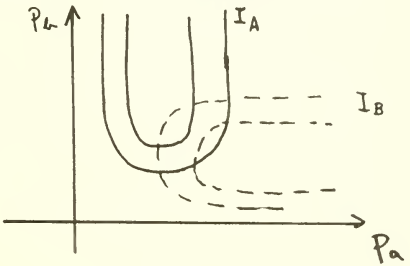


Fig. 4.

The equilibrium conditions for each firm $\frac{dP_a}{dt} = 0$ and $\frac{dP_b}{dt} = 0$ describe the response in hostility level of one organization to a given hostility level of the other organization. In this particular setting, the response curve is to be the locus of points that yield maximum profit when the rival's price level is given. This is a Cournot response function, which in our graph is the set of points where the slope of indifference curves are horizontal for firm A and vertical for firm B. This results in Fig. 5.

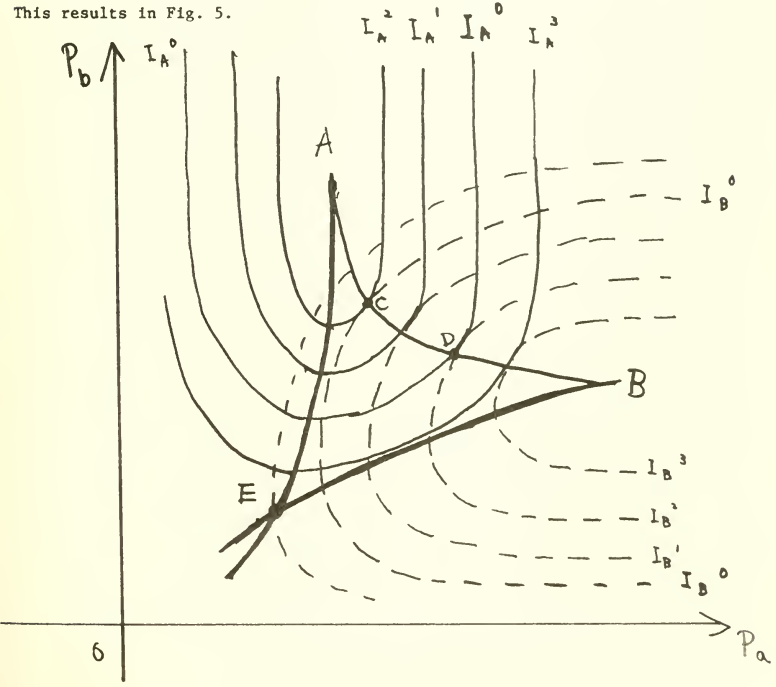


Fig. 5.

The equilibrium point is E. But this point obviously does not satisfy the necessary condition of optimality. As we move from E to the inner area of figure AEB, both parties will be better off. Therefore E is not Pareto optimal. Restating this, the necessary condition of Pareto optimality is an equality of slopes of two isoprofit curves. So a set of Pareto optimal points is given by a curve A-B. Since both indifference curves cross orthogonally at E by definition, E can not be on the curve A-B.

Thus the equilibrium point E is not a rational solution for both parties. This conclusion means not only that the conflict will lessen the profits otherwise attainable, but it may also mean that both parties can not survive at point E. For example let the I^{o}_{A}, I^{o}_{B} curves correspond to break-even profits. In this case, if they would behave cooperatively and if they could be on the line C-D of the Pareto optimal set, they could survive. But the dynamism of conflict between them leads them to point E where both parties are bound to die out.

SUMMARY

In the introduction it was pointed out that in our society the market mechanism and voting system whose desirability is justified in current scientific theories have become obsolete and that socially important decisions are made as a result of inter-organizational conflict. For that reason, developing a theory which analyzes the mechanism, the result and the properties of inter-organizational conflict is a valuable direction for research.

Section I introduced (1) the definitions of the basic concepts of conflict at a very general level and used these definitions as a base, (2) built a static model which identifies the direction the influence will take. Section 2 extended this to a dynamic model under some simplifying assumptions, and answered such questions as (3) "When two organizations behave simultaneously in the way we assumed, on what trajectory and to what state will the system be directed?" and (4) "Does the system reach a dynamic equilibrium state or not?" If the equilibrium exists, (5) "What is the stability condition and how can it be interpreted socially?" The model was generalized to the N-Party conflict. It was used to derive (6) its equilibrium and stability condition and discussed (7) the relation between partial and global stability. In the last section, (8) the question of whether the stable equilibrium (if it exists) is a rational situation or not. And in constructing a specific model, it was shown that it is clearly not rational.

Some weaknesses of our model need to be pointed out. In the first place the setting of the model is a very pure conflicting situation in the sense that it neglects the possibility of communication and rational cooperation. In a real conflict even if communications are not allowed, each organization has informal knowledge and techniques to obtain a cooperation.[20] In addition, there exist various social inventions (law, contract, voting scheme, social custom, etc.) to control conflicts. Therefore the resolution of a conflict in the real world may be better than we have predicted. In the second place, the organization was described only in terms of "macro variables" like "identification," "frustration," "aspiration level" etc. As a result, the properties of conflict which is peculiar to inter-organizational conflict are not sufficiently analyzed. In fact the model may even look as if it were one of individual conflict. An organization is a body of decision making individuals and it seems necessary to take this fact explicitly into our model.

Thirdly although the model is effective in pointing out both the mechanism and the undesirability of inter-organizational conflict, it is not well equipped to discuss the way of conflict resolution, which may be more important for practical purposes.

NOTES:

(1) This view has already been pointed out by many social scientists. Among them the following are very important. (Boulding, 1953), (Galbraith, 1956), (Galbraith, 1969), (Galbraith, 1971).

(2) Namely a state of any conflict is assumed to be represented completely or at least sufficiently for the purpose of this work. This may sound a very strong statement. But this is a convention which has been adopted by leading scientists in this field. For example, (Boulding, 1962), (Rapaport, 1960), (Richardson, 1960).

(3) I use "proposition" in Homans' sense. See (Homans, 1967).

(4) This proposition is also supported by the findings in social psychology. For example see (Osgood, 1962), (McNeil, 1965, ch.17). Also the same conclusion is obtained in the game theoretic experiment. For example see (Rapaport et al, 1962).

(5) See (McNeil, 1965).

(6) For detail see (March and Simon, 1958, pp.65-81).

(7) For example see (Machiavelli, 1935). (Orwell, 1949) and (Tolstoy,) give a very interesting discussion.

(8) For instability of a feedback loop, see (Lange, 1965), (Takamiya, 1972).

(9) In psychology there are three representative views on behavior under frustration. They are (i) frustration-aggression theory, (ii) frustration-persistence theory and (iii) frustration-degeneracy theory. For the brief ecplanation of these views, see (Suenaga (ed), 1965, pp. 115-117).

(10) For the explanation of this experiment, see (Lambert, 1973) and (Newcomb, 1965) and (Miller and Dollard, 1941).

(11) About this experiment, see (Rapaport, 1969, p.83).

(12) For the survey of these experimental researches, see (Rapaport, 1962), (Suzuki, 1970, ch. 9-11), (Lave, 1965) and (Siegel and Fouraker, 1963).

(13) For example, Boulding tries to explain this relation by using the "core" of the value system as his basic concept. See (Boulding, 1962).

(14) This assumption, however, is inconsistent to Proposition 1.2 and 1.4. It was asserted that as hostility increases, the identification increases, which in turn raises hostility. So far as hostility is not assumed to be fixed, identification should not be assumed to be fixed. However introducing this feedback relation into our model hardly seems to be worth the cost of the technical complexity.

(15) The following formulation is largely due to (Richardson, 1960). The reader can find an introductory explanation of the Richardson Model in (Boulding, 1962) and (Rapaport, 1960).

(16) See (Richardson, 1960, ch. 2, pp. 12-38, especially p. 15) and for further illustration see (Grey, 1925).

(17) See (Boulding, 1962). (Richardson, 1960).

(18) See for example (Pontriagin, 1962).

(19) This section is largely due to Boulding's interesting work (Boulding, 1962).

(20) By this I essentially mean Schelling's argument of resolution of conflict by the prominent alternative. See (Schelling, 1960).

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